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"A METHOD OF MAKING DECORATIVE PANELS OF STONE MATERIAL OR THE LIKE"

DESCRIPTION

The present invention refers to a method of making decorative panels comprising slabs of stone material or the like, for instance marble or granite.

Known methods show that, to this purpose, on a basis support a stack or package of layers is formed, said layers consisting of parallel slabs of the decorative stone material, and of additional layers, such as framework or reinforcement layers and separating layers between the panels. Then the package is placed inside a liquid-tight formwork, and a depression is therein created and maintained while feeding a hardenable fluid binder intended for encapsulating the stack and for penetrating into interstices among slabs, consolidating possible fractures of the slabs themselves. Afterwards, the binder is made to harden so to obtain a monolithic block that is cut to produce panels comprising at least one decorative slab joined to at least one framework layer.

Examples of these methods are disclosed in WO-A 91/08093 and in the Italian patent application No. TO92A000988. WO-A 91/08093 further suggests to insert, between one head of the stack and the adjacent wall of the formwork, a bin-shaped filling element in order to fill the empty space left by a stack formed with slabs of length smaller than the formwork. This prevents wastes of quite expensive binder.

The known method has a certain number of disadvantages.

The stack must be formed with equal slabs, and this is not easily obtainable due to the different sizes of the raw blocks, or a trim is required, which makes costs increase.

Moreover, a series of different filling elements must be provided so to be adapted to different lengths stacks, and this makes costs increase too. As the number of different filling elements will be obviously limited, an exact compensation will be rarely possible and there will be often need to fill the remaining empty spaces with the quite expensive binder.

Furthermore, it is difficult to obtain in the formwork vacuum conditions such as to allow the penetration of the binder all over the block, due to the presence of both humidity and gaseous residuals generated by the binder.

Finally, the raw panels obtained after cutting have a reinforcement layer on one side only of the stone material slab: so it is automatically identified the side to be polished (that without reinforcement), and this implies the impossibility to produce slabs with different superficial treatments, such as open-stain or continuous-vein slabs.

As it is known, actually, by cutting a thick slab in half, the open-stain are the two internal sides, the continuous-vein are instead the internal side of a slab and the external side of the other one, the aesthetic result being of course very different.

According to the invention a method is instead provided that

overcomes the drawbacks of the known prior art.

These and other objects of the present invention are achieved with the method defined in the following claims.

For better explanation reference is made to the attached drawings, in which:

- fig. 1 is a schematic elevation view showing the formation of a stack of slabs;
- fig. 2 is a sectional partial view, scaled up, of the stack of fig. 1;
- fig. 3 is a vertical section schematic view of a formwork in which the binder casting takes place;
- fig. 4 is a schematic view from the above of a stack portion impregnated with binder;
- fig. 5 is a vertical section schematic view showing the cutting step of a lateral side of the stack of fig. 4; and
- fig. 6 is a vertical section schematic view of a raw panel.

With reference to figures 1 and 2, numeral 1 denotes a stack of superimposed layers comprising slabs 2 of the decorative material, for instance marble, granite, etc., alternated with additional layers 3, 4. If slabs 2 in stack 1 have different sizes, it is possible, already during the stack formation, to make a compensation of the size differences by arranging along one or more edges of the smaller slabs elements 20A of stiff material, for instance pieces of the same slabs 2 material. These additions will be kept in position, in this step, by the weight of the

overlaying slabs.

An alternative way of carrying out such compensation will be described later on.

Layers 3 are framework sheets or thin slabs, while layers 4 are separating or detaching layers between the single panels and they consist of sheets or thin slabs too or of a fluid layer.

As also disclosed in WO-A 91/08093, stack 1 is formed on a support structure 5, capable of supporting, all their extension long, slabs of commercially used maximum sizes (for instance about 3.50 m x 1.55 m). Support 5 can comprise only a horizontal basis, as in figure 1, or the basis and a longitudinal vertical wall. The second solution is useful for forming a stack 1 with vertical slabs or for vertically arranging a stack such as that of fig. 1 before feeding a fluid binder inside a cast container. Slabs 2 are stacked by using for instance a travelling crane system having a frame 6 vertically movable and equipped with suction caps 7, while the additional layers 3 and 4 can be applied by hand.

Each slab 2 is in contact, on both its main sides, with a reinforcement layer 3, and each of the two reinforcement layers 3 associated to a slab 2 is in contact with a separating layer 4. Preferably, the reinforcement layers 3 have such a structure to allow the passage of the fluid binder (for instance a synthetic resin hardenable at room temperature), intended for impregnating and encapsulating stack 1. Layers 3 have for instance a net structure. Thanks to the presence of layers 3 on both sides of

each slab 2, the binder effectively penetrates all over stack 1, entirely consolidating possible fractures in slabs 2.

Separating layers 4 are made of a material that does not adhere to the binder, so to make the separation of adjacent panels easy.

Further features about the structure and the materials of layers 3 and 4 are contained in said prior documents, to which reference is made.

With reference to figures 3 and 4, around stack 1 a liquid-tight sturdy metallic formwork 10 is formed that, in the shown embodiment, works also as an autoclave for the impregnation of stack 1 with the fluid binder. Formwork 10 is constructed by joining the necessary lateral walls 8 to support 5 and by adding a closing lid 9. Not shown gaskets guarantee the tightness. Some room for the passage of the binder must be left between the sides of stack 1 and the walls of framework 10, and to this purpose spacing elements, not shown, can be employed. If the stack sizes do not correspond to those of the formwork 10 (except the aforesaid space), filling elements 21, which will be described later on, are provided between lateral walls 8 and stack 1. Formwork 10 is constructed after having arranged stack 1 with the layers being substantially vertical.

Formwork 10 can also form a simple cast container, open on one side, that will be further inserted into a suitable autoclave.

Before feeding the binder, possible differences among the

sizes of slabs 2 are compensated, in case these differences have not already been compensated during the formation of stack 1.

To this purpose, a high density (higher than the one of the binding material) expandable material, for instance polyurethane, is introduced into formwork 10. This material is fed at the liquid state through one or more ducts 11 and it is made or let to expand so to fill the empty spaces left from small size slabs 2. Due to the high density, the expandable material remains confined near the edges of slabs 2, and it does not penetrate into the spaces between the various layers of stack 1. The presence of an expanded material on the periphery of the layers adjacent to the involved slab is not important, since such material will be removed with cutting.

The same material can be employed to form, at least partially, the filling elements 21 necessary to bring stack 1 in contact with the walls of formwork 10. In this case, the filling elements formation will take place simultaneously to the size differences compensation of the slabs: practically, one or more filling elements 21 will have protruding portions that join the involved slabs, as shown in 20B in fig. 4.

The expanded and solidified material of these elements 21 can be also recovered after the panels separation and reused for an approximate adaptation between the sizes of stack 1 and formwork 10. Then liquid material will be added to compensate the remaining differences. The solid filling elements 21 can be

mounted in the formwork before introducing stack 1.

In a variant, the filling elements 21 are made of air cushions: these can be introduced too in formwork 10 before stack 1.

Fluid binder 15 feeding takes place after that a depression has been created in formwork 10, by evacuating air through one or more ducts 12. During air evacuation from formwork 10, stack 1 is advantageously heated so that the possible humidity still present upon reaching the vacuum condition evaporates. Moreover, formwork 10 can be associated to a freezing system (not shown) for the humidity evaporated in consequence of heating. This way the remaining humidity is made unimportant for the cycle.

Binder 15 is fed from the top, through a duct 13 provided in lid 9, or from the bottom to facilitate the evacuation of the remaining air. It is spread out into all the interstices among the single components of stack 1, around stack 1 and below it, also completely or partially wrapping the filling elements 21. Penetration inside stack 1 is facilitated by the presence of the reticular reinforcement layers 3 on both sides of each slab. Binder feeding ends when all stack 1 is covered by a liquid binder head of a few centimetres.

Binder 15 is degassed while is fed in the formwork, so to reduce the generation of gaseous residuals. In order to help to create vacuum conditions, a washing of formwork 10 with inert gases is also preferably carried out, said washing allowing to

eliminate humidity residuals.

Upon termination of the binder feeding, the inside of formwork 10 is brought to a pressure higher than the atmospheric pressure so to create a piston effect that facilitates the hardening. Once the binder is hardened, a monolithic block is obtained in which hardened binder 15 wraps stack 1, consolidating possible deposits 20A for adapting sizes for single slabs 2, and wrapping or joining filling elements 21 to stack 1, as visible in fig. 4. In this figure are visible a slab 2A having an addition 20A obtained during the formation of stack 1, and a slab 2B having an addition 20B obtained from the expandable material and integrated with a filling element 21.

The monolithic block is taken out from formwork 10 and it is brought to a cutting station, where cutting preferably takes place according to the modes disclosed in the Italian patent application No. TO92A000988. In other words, and as visible in fig. 5, block 16 is cut, on all the lateral sides, perpendicularly to slabs 2 extension plane, so to remove not only the layer of hardened binder 15, but also possible layers of expanded material and solid filling elements 21 and an edge portion 22 of stack 1 layers. This way separating layers 4 not adhering to the binder are exposed to air and an easy separation of the panels is allowed, as disclosed in said Italian patent application.

As said, solidified filling elements 21 can then be reused.

In fig. 6 a raw panel is shown obtained by block 16. Panel

25 has a reinforcement layer 3 on both sides. One of such layers shall be obviously removed in the following polishing step. Nevertheless, the fact of being able to choose the side to be polished causes the possibility to choose among different kinds of superficial polishing, for instance in order to obtain open-stain or continuous-vein slabs.

It is evident that what has been disclosed is given as a non limiting example and that variants and modifications are possible without going out the protective scope of the invention.